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ABSTRACT

Several years ago, the English faculty at the Schuylkill Campus of Pennsylvania State University entered into a cooperative venture with the campus learning center to use computer-assisted instruction in the basic rules of grammar as part of the remedial English course. The software used for the lab is the Houghton Mifflin English Microlab program, which consists of a 75-item assessment test, a 50-item quick check test, 11 mastery tests, a data disk to record scores, and 11 modules. The software provides instruction in complete sentences, run-ons and comma splices, misplaced modifiers, subject-verb agreement, pronoun choice, commas, apostrophes, semicolons and colons, parentheses and dashes, quotation marks and italics, and capitalization. Results of student evaluations of the microlab program and a statistical analysis of achievement gains led to the following conclusions: (1) high achievement levels were evidenced by students who did at least 20 exercises and worked on at least 8 instructional modules; (2) some students who worked on fewer than five modules had lower scores on the post-test than they did on the pre-test; (3) although males did better on the pre-test than females, males and females did equally well on the post-test; and (4) when asked what they liked least about the program, the most frequent comments were "It was too time-consuming," "The program ran too slowly," and "There wasn't enough feedback on errors," while the most frequent positive comments were "It helped me learn more about grammar," "It was easy to understand," and "I could always get the module I wanted, a computer, and help if I needed it." Guidelines for setting up a similar program are included. (EJV)

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THE IMPACT OF COMPUTER-ASSISTED INSTRUCTION ON STUDENTS' KNOWLEDGE OF BASIC WRITING SKILLS

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May 10, 1988

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FOREWORD

Many people are skeptical about the value of computer-assisted instruction in grammar. The experience of this writer has shown that it can be beneficial if it is implemented properly. English faculty and Learning Center staff must be willing to work together for the benefit of the student to make computer-assisted instruction work. Computers are simply additional tools that can be used to provide supplemental instruction to students. They should be used in conjunction with personal help from faculty and Learning Center staff.

In putting this project together, I had assistance from a number of people whom I would like to thank. Dr. Helen Hendy, Assistant Professor of Psychology, spent many hours doing the statistical analysis of the data. Lee Lesisko, a student in my business writing class, entered the statistical data into a computer program to produce graphic representations of the data. Kathleen Campion, LOFT student secretary, worked diligently to type a number of copies on the word processor and remained calm and pleasant even when one whole section of the paper was mysteriously unable to be retrieved from the disk. Elaine Meneely, LOFT computer-assisted instruction specialist, worked conscientiously with the students on the lab and helped complete the data. Last, I want to thank the English faculty for their cooperation with this project.

Teachers who believe students should have a basic understanding of grammar in order to improve their writing and to understand teachers' comments on their papers are faced with the task of having to teach both grammar and writing without enough time to do either very thoroughly. Computer-assisted instruction offers a way for teachers to spend more class time teaching writing skills, while providing students with a needed review of the basic rules of grammar in a small group computer-lab setting outside of class. Assigning students to small groups to work on computer programs in the Learning Center has the added bonus of getting them into the Learning Center where they can learn to ask for help from the Learning Center staff.

DESCRIPTION OF ENGLISH MICROLAB PROGRAM

Several years ago the English faculty at the Schuylkill Campus entered into a cooperative venture with the LOFT Learning Center to use a computer-assisted instructional component as part of English 4, which is the remedial course Penn State offers to students with deficiencies in English. This program has been used and modified over the last few years until it is now working smoothly and effectively. The first day of class students make a copy of their schedule, which is then sent to the Learning Center English specialist whose job it is to assign students to specific lab groups which will meet when students have a common free period. The Learning Center has twelve Apple IIe computers, which it reserves for this project: therefore, students are assigned to groups of twelve. The software used for the lab is the Houghton Mifflin English Microlab program, which consists of an Assessment Test of 75 items, a Quick Check test of 50 items, 11 Mastery Tests of 15 items

each, a Data Disk to record scores, and 11 modules providing instruction in the following areas: A) Complete Sentences, B) Run-ons and Comma Splices, C) Misplaced Modifiers, D) Subject-Verb Agreement, E) Pronoun Choice, F) Commas, G) Apostrophes, H) Semicolons and Colons, I) Parentheses and Dashes, J) Quotation Marks and Italics, and K) Capitalization. The lab groups meet weekly throughout the semester, starting the second week. It takes a minimum of twelve 50-minute periods to work through the entire program. Students record their scores on the pre-test, the module exercises, and the post-test on a progress chart, which is kept on file in the Learning Center. By reviewing their progress charts, teachers can determine if the software is having any positive effect on students' learning, and if students are attending labs and completing the work. They can see a carryover effect to the classroom when students begin understanding the comments on their papers and improving the grammar in their written work.

The first few times we used the Houghton Mifflin English Microlab, the students took the Assessment Test that came with the program. This test gives a weighted evaluation of errors, which means, for example, that a fragment error has a greater weight than a colon error. The test then prescribes a study plan listing those modules in which the student is weakest. The test stresses the idea that students ought to study what they don't know first, and if they want to, they can review the other topics later. As a diagnostic instrument this test is satisfactory; however, because it is not organized in the same way as the Mastery Test given at the end, it is hard to make a direct comparison of the pre- and post-test scores. The original Assessment Test has 75 questions covering all types of grammar problems; whereas the Mastery Test is really 11 separate tests of 15 items each, which directly tests each of the

11 modules. Because we wanted to see a unit-to-unit relationship, we decided to use the Mastery Test that came with the Microlab computer program as a pre-test and construct two paper post-tests (Forms A and B) that were designed like the computer test to use in post-testing the students. When we tried to post-test students with the computer test, we ran into a number of difficulties including 1) too many students and too few test disks, 2) cheating, 3) lack of privacy in the computer lab setting, and 4) scheduling problems. Paper tests allowed us to handle a large number of students more easily with better supervision. If students did poorly on the first paper test, they were allowed to restudy the material and take the second form of the test a week or two later. All sections of English 4 took the test in the auditorium, which was open for a period of six hours. Students came in to take the test on the assigned day whenever they had a block of two hours in their schedule. Special arrangements were made for those who couldn't find a two-hour block of time. Students were not allowed to cut other classes to take the test. The teachers agreed to urge the students to aim for a minimum achievement level of at least 80% on the test, but used the University's scale of grading to assign the final grade, which most teachers counted as 20% of their total grade.

Learning grammar in a lab setting requires that students attend labs regularly and involve themselves actively in the learning process. The English specialist in the lab does not take attendance, but students are required to record modules completed on their progress chart. The person in charge of the lab makes periodic reports to the teachers about the progress students are making. She is also available to help students with the modules if they continue to have problems understanding the grammar or punctuation.

after they have finished the module. Her presence in the lab has a motivating effect on students because they know someone is keeping track of them and knows when they are not staying on schedule with their work.

Each module has a standard format. A content review briefly explains the basic concepts, definitions, and rules that the student must know in order to complete that module correctly and presents some examples to illustrate the rule being taught. While these reviews are not as in depth as a textbook explanation or a classroom presentation would be, they do give an adequate explanation to jog people's memories about information to which they were previously exposed. In each practice set, students are referred to specific pages in their companion workbook, Evergreen, by Fawcett and Sandberg, for more information about the concept. They are also told how to find information in other grammar books. There is room on their progress charts to record workbook page numbers for future reference.

After the review, the students complete three practice sets of 15 questions, each of which asks for recognition of correct or incorrect sentences, and three sets of 15 questions, each of which asks for sentence repair for a total of 90 items per module. The student can control how many exercises he or she will do. Students are encouraged to do all the exercises in any module topic on which the Assessment Test reveals they are weak (less than 80% or 12/15). The computer generates scores for each practice set (14/15=93%), and students record these scores on their progress chart.

GUIDELINES FOR SETTING UP A PROGRAM

Teachers who want to set up a similar program should keep the following guidelines in mind:

1. For most effective use of the Microlab, instructors and lab tutors must be familiar with the program. While the documentation is clear and the program is easy to use, direct experience with the Microlab is still the most valuable means of getting to know the program, so it can be used to best advantage.
2. Students must get a thorough explanation from their classroom teachers or from the lab tutor about how the program works, what their responsibilities are, and how to fill out the progress charts before being sent to the lab. They should also be given a few basic pointers about using the computers.
3. Teachers and lab tutors should maintain frequent contact to keep constant check on the students' progress.
4. There should be a lab tutor available during lab sessions to check software in and out and help students with the exercises when they run into trouble. The tutor should not plan to do any other work during lab periods.
5. Although students could work on this program during any free period, scheduling them in a small group for a specific time makes it easier to schedule a tutor to help them and keep track of software and progress charts.
6. It is important for all teachers to prepare and review the paper post-tests (Forms A and B) before the tests are given and to agree on answers. We found it helpful to test all students at the

same time and get together afterward to correct the tests.

7. There should be at least 12 copies of the pre-test computer disks available for use as assessment instruments so the entire group can be assessed the first day. (Note: we used the Microlab Mastery Test disks as pre-tests). Five copies of each module should be more than adequate since each student can work on a different module.
8. The lab tutor should explain how to run the program, use the progress charts, and handle the disks properly before doing anything on the first day. A second explanation reinforces what students should have heard previously and gives students a better understanding of the lab procedure.

The English Microlab can be used in the laboratory, classroom, or office. Students can work through the practice modules on their own time or during assigned visits to the laboratory. Several students can work at the same module at one computer to provide support and stimulation for one another. Since the program makes no noise, it can be used by several students in the classroom while others are writing or working in groups. Since personal computers have become more common in offices, it can also be used as a tutorial in basic skills to save time for busy teachers.

STUDENTS' EVALUATION OF PROGRAM EFFECTIVENESS

In an effort to learn how students liked using the program, we surveyed the eighty-two microlab users at the end of the semester. Most students had generally positive feelings about it considering that they usually dislike the study of grammar (See Appendix for copy of questionnaire and summary of

results). Students were asked to evaluate various aspects of the program on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree). As far as the content of the program was concerned, 69% agreed or strongly agreed that the directions and explanations were clear. Fifty-five percent agreed or strongly agreed that the level of the subject matter was appropriate for college freshmen. Sixty-one percent agreed or strongly agreed that the modules covered each subject adequately.

When asked to evaluate the instructional design of the program, 86% agreed or strongly agreed that the program was easy to use, and 68% believed it presented material in a logical order. Sixty-one percent said the program disks ran without difficulty, and 49% felt the feedback from the modules was helpful.

When asked about the effect of the program on their writing, 70% thought the computer was a helpful means of instruction; 53% thought the Microlab helped them improve their writing; 53% thought the program increased their understanding of English; and 17% thought that a workbook or classroom presentation would have been more helpful.

In response to questions about how the lab was organized, 46% thought that an instructor should work more closely with the Microlab Groups; 59% felt the explanations of how to complete the lab and fill out the progress charts were clear; 67% believed the time assigned for lab work was convenient; and 82% said computers were available for them at their scheduled times.

When asked how much effort they had put into the program, only 14% said they had exerted 100% effort; 21% believed they had made 50% effort; and 9% said they had made less than a 50% effort.

Forty-eight percent said they had taken the program seriously and found

it helpful. Only 25% found the program motivational. Thirty-five percent chose the middle ground on this question and 36% disagreed that it had any motivational qualities at all. (We found these results somewhat surprising because the students who worked with the program the previous year found the program much more motivational than either workbook exercises or classroom presentations and seemed to enjoy working with it.)

When asked what they liked least about the program, the most frequent comments were the following: "It was too time-consuming." "The program ran too slowly." "There wasn't enough feedback on the errors." "The grammar reviews could have been done better in the classroom." "Some of the questions were 'ify' and could be interpreted in more than one way." "It was boring at times." "The lab time didn't fit my schedule," etc.

The most frequent positive comments were these: "It helped me learn more about grammar." "It was easy to understand." "I could always get the module I wanted, a computer, and help if I needed it." "You could work at your own pace." "It helped me understand some of my weaknesses." "It refreshed my memory about punctuation and grammar." "It helped me with my English essays."

In conclusion, 85% of the students surveyed believe that an understanding of English grammar and writing skills is important to their success in college and in their career; however, they did not act on this belief by putting their best efforts into their work. While we can learn some important things from soliciting student opinion, it is often a "mixed bag." To get a truer picture of the effects of instructional methods, we must use a more scientific approach.

STATISTICAL ANALYSIS OF PROGRAM EFFECTIVENESS *

The scores of the 82 students (52 males and 30 females) who completed the lab program were analyzed to determine if this program had had any significant effect on student learning. As we gathered information for the study, we realized that the pre-tests and the post-tests had not been designed exactly the same on two of the modules, Pronoun Choice and Subject-Verb Agreement. Instead of asking students to decide whether a sentence was correct or incorrect, these module post-tests asked students to select the correct answer from a choice of two possible answers. Students' scores were lower on these two module post-tests where the format differed and the questions were more difficult. Consequently, we prepared two sets of data: a comparison of pre- and post-test scores on the eight modules for which the testing format was similar and another comparison of pre- and post-test scores on the entire ten modules. We did not include the scores for Module I (Parentheses and Dashes) because we felt the rules are not specific enough in this area to hold students accountable for them. Using dashes and parentheses is often a matter of personal preference rather than correct or incorrect use.

The mean score on the eight module pre-test was 71% with a range of 52-88%: for the ten module pre-test the mean was 69% with a range of 53-87%. The mean score on the eight module post-test was 74% with scores ranging from 56-91%: on the ten module post-test the mean was 70% with scores ranging from 50-87%. The mean difference between the pre- and post-test scores on the eight modules showed a mean gain of 3.4%. On the ten modules, the mean gain was only .4%. Students completed a mean of 26.7 exercises over the ten modules out of a total of 60 exercises. The mean number of modules completed was 6.9 out of a possible 10.

Pearson Correlation Coefficients were calculated to examine the relationship between the number of exercises completed and student achievement and the relationship between the number of modules completed and student achievement. The analysis of the relationship between the number of exercises completed and post-test scores revealed significant correlations between the number of exercises completed and the scores on the eight module post-test (r=.30, n=82, p<.05) and between the number of exercises completed and the scores on the ten module post-test (r=.24, n=82, p<.05). These results indicate that the more exercises and the more modules the students completed, the better their scores were on the post-tests. There was also a significant correlation between the number of exercises completed and the difference (or improvement) between the pre- and post-test scores on the eight module test (r=.20, n=82, p<.05). There was no relationship between number of exercises completed and the difference between the pre- and post-test scores on the ten module test.

A second analysis revealed significant correlations between the number of modules (of ten modules) for which at least one exercise had been completed and the scores on the eight module post-test (r=.38, n=82, p<.001), and between the number of modules completed and the scores on the ten module post-test (r=.33, n=82, p<.01). There was also a significant correlation between the number of modules completed and the difference between the pre- and post-test scores for the eight modules (r=.37, n=82, p<.001), and the number of modules completed and the difference between the pre- and post-test scores for the ten modules (r=.28, n=82, p<.01).

To get a more graphic picture of the relationship between the number of exercises completed and post-test performance, the 82 students were divided into three groups for further analysis: 1) students who had done 0-19 exercises (n=39), 2) students who had done 20-40 exercises (n=30), and

3) students who had done 41-60 exercises (n=23). Then, analysis of variance was used to compare these three groups of students on their pre-test and post-test scores for both the eight module and the ten module post-tests. Although the three exercise groups did not differ significantly on their pre-test scores, indicating they had started with the same abilities, the groups did differ significantly in their post-test scores when considering eight modules (F=4.99, df=2/79, p<.01) or when considering ten modules (F=3.16, df=2/79, p<.05) (See Figures 1 and 2). These results again indicate that the more exercises the students completed, the better was their eventual achievement in the program. Finally, from Figures 1 and 2, it appears that final performance was best if the student completed at least twenty exercises.

Figure 1: Relationship Between Number Of Exercises Completed And Achievement On Eight Module Post-Test

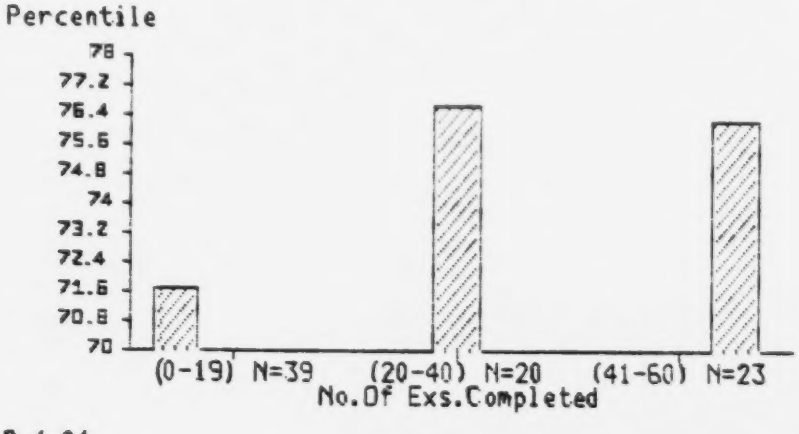

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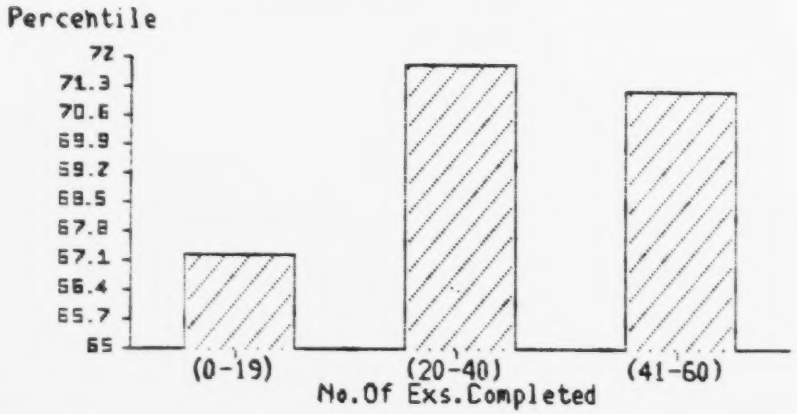
Figure 2: Relationship Between Number Of Exercises Completed And Achievement On Ten Module Post-Test



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Students were also assigned to three groups based on the number of modules in which they had done at least one exercise: 1) students who worked in 0-2 modules (n=15), 2) students who worked in 3-7 modules (n=18), and 3) students who worked in 8-10 modules (n=49). Analysis of variance was used to compare these three groups of students on their pre-test and post-test scores (again, separately for the eight module post-test and for the ten module post-test). Although the three module groups did not differ significantly on their pre-test scores, indicating that they had started with the same abilities, the groups differed significantly on their post-test scores, both over the eight modules ($F=4.85$, $df=2/79$, $p<.05$) and over ten modules ($F=3.32$, $df=2/79$, $p<.05$) (See Figures 3 and 4). These results again indicate that the more modules the students completed, the better their eventual achievement was in the program. Finally from Figures 3 and 4, it appears that final performance was best if the student completed at least 8 to 10 modules.

Figure 3: Relationship Between Number Of Modules Worked In And Achievement on Eight Module Post-Test

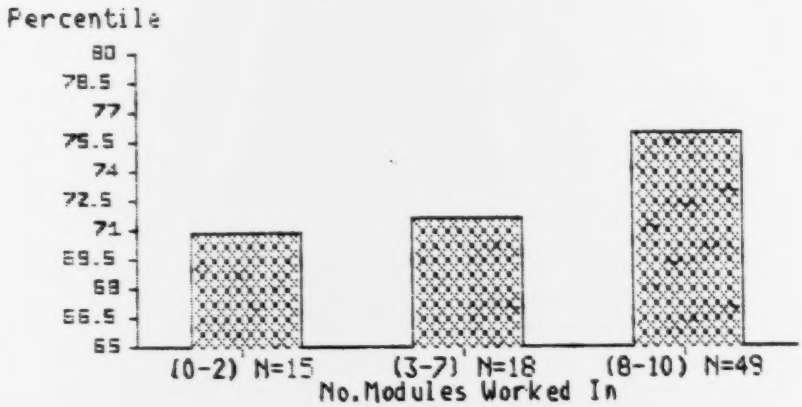

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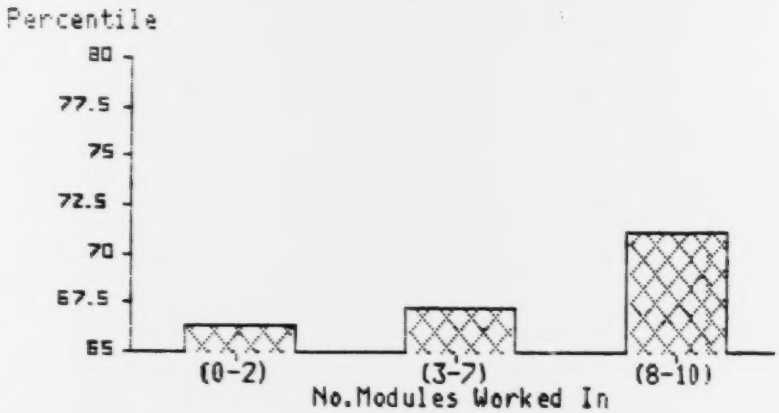
Figure 4: Relationship Between Number Of Modules Worked In And Achievement On Ten Module Post-Test



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In an effort to obtain a closer look at the relationships between number of exercises completed and final achievement, and between number of modules completed and final achievement, the 82 students participating in the program were divided into five groups according to the number of exercises completed or according to the number of modules completed (See Figures 5, 6, and 7). Analysis of variance revealed that a comparison of the five exercise groups for their post-test scores on the eight modules nearly reached statistical significance (F=2.33, df=4/77, p<.07) (See Figure 5). In addition, analysis of variance used to compare five module groups showed that they differed significantly in their post-test scores over either eight modules (F=4.12, df=4/77, p<.01) or over ten modules (F=3.05, df=4/77, p<.05) (See Figures 6 and 7). Overall, these results once again indicate that the more exercises and the more modules a student completed, the better his or her final achievement in the program.

Figure 5: Relationship Between Exercises Completed And Achievement On Eight Module Post-Test (Five Groups)

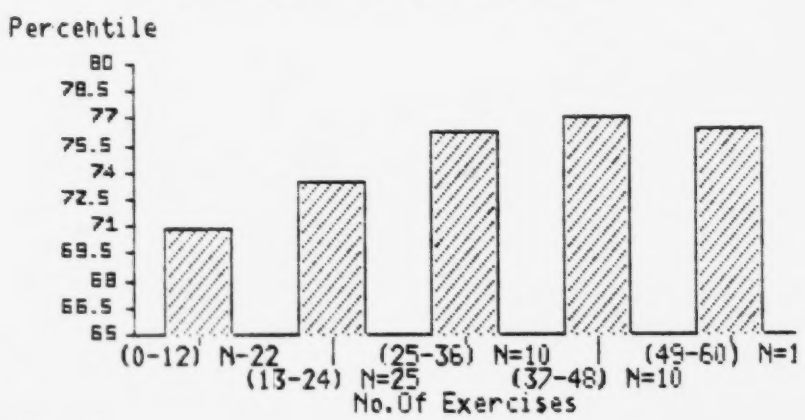

Figure 6: Relationship Between Number Of Modules Worked And Achievement On The Eight Module **Post-Test (Five Groups)**

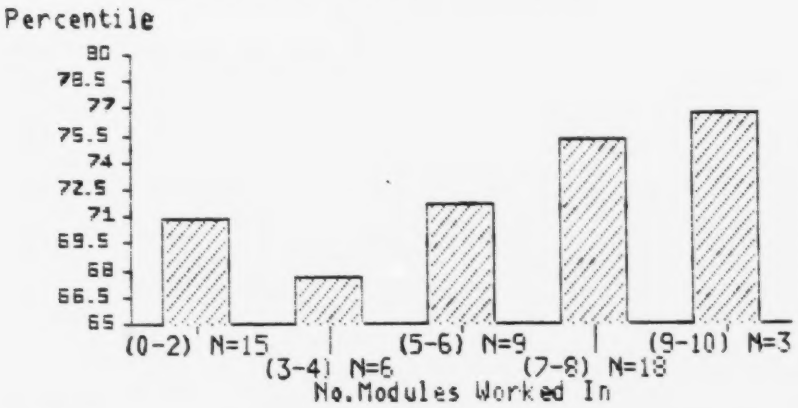

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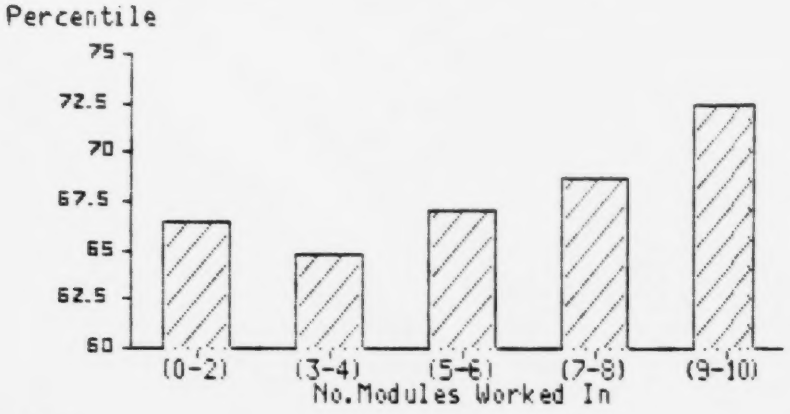
Figure 7: Relationship Between Number Of Modules Worked In And Achievement On The Ten Module **Post-Test (Five Groups)**



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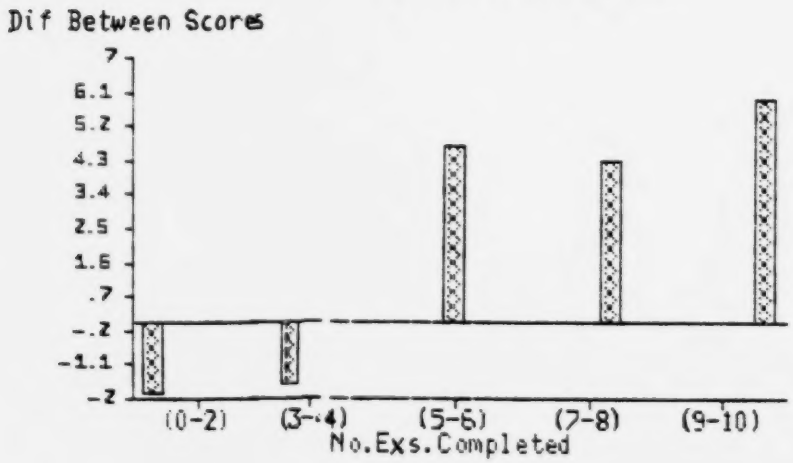
When the above analysis of variance was used to compare five module groups on their improvement from pre-test to post-test, some interesting findings were noted (See Figure 8). Students who worked in four or fewer modules actually lost points (F=3.39, df=4/77, p<.05). Those who did exercises in two or fewer modules showed a mean drop of 1.9% from pre-test to post-test scores. Those who did exercises in three or four modules showed a mean drop of 1.7%. Only students who did exercises in at least five modules showed a gain in their scores from pre-test to post-test.

Figure 8: Difference Between Scores On Eight Module Pre-Test And Eight Module Post-Test



To check if other factors were related to the students' performance, t-tests were used to compare the pre-test scores, post-test scores, the number of exercises completed, and the number of modules in which at least one exercise was completed for males (n=52) and females (n=30). Males were found to do better than females on the pre-test, when considering eight modules (t=2.66, df=80, p<.05) or when considering ten modules (t=2.35, df=80, p<.05) (See Figures 9 and 10). However, males and females did not differ in post-test scores over either eight or ten modules, indicating that somehow their differences in performance were eliminated over the course of the program. It is not clear that their utilization of the program itself eliminated this difference, because males and females did not differ significantly in either the number of exercises or modules completed.

Analysis of variance revealed no significant differences in the post-test scores for students who had had three different teachers (n=23, n=14, n=45 for each of the three teachers) in spite of the fact that students of one of the teachers did significantly more exercises than the students of the other two teachers (F=5.38, df=1/35, p<.05). Students may have gotten more information from the other two teachers in their classes; whereas the one teacher may have depended solely on the Microlab for grammar instruction.

Figure 9: Sex Differences Between Scores On **Eight Module Pre-Test**

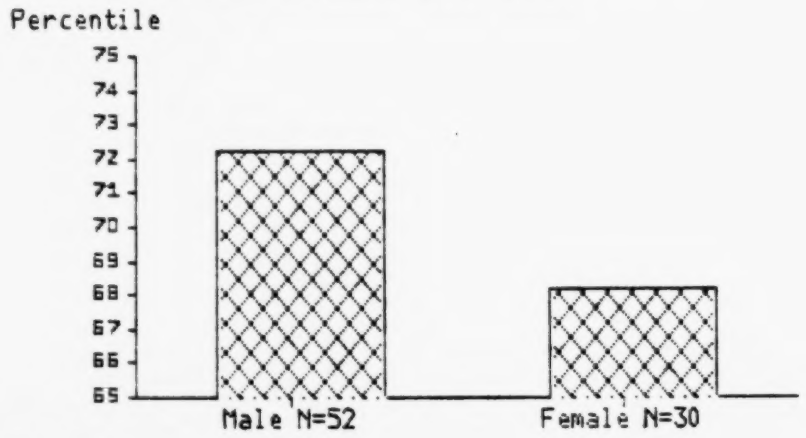


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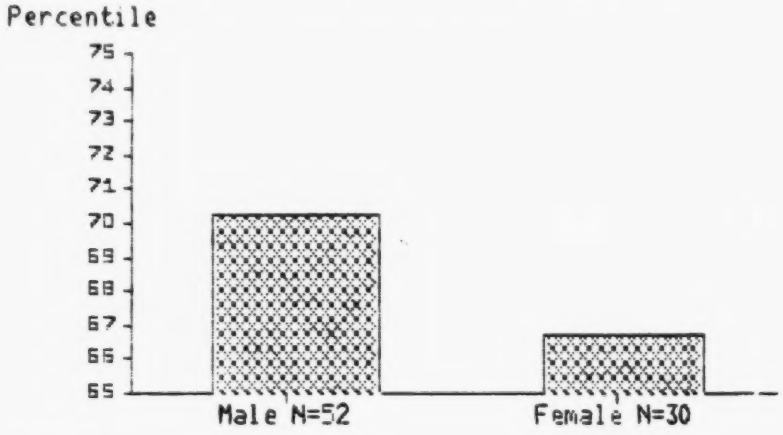
Figure 10: Sex Differences On Scores Of Ten Module Pre-Test



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CONCLUSIONS

1. There is definitely a correlation between the amount of effort a student puts into the Microlab in terms of the number of modules and the number of exercises completed and the improvement noted in his or her post-test scores.
2. Students who do at least 20 exercises appear to show the best final achievement.
3. Students who work on at least 8 to 10 modules show the best final achievement.
4. Students who work at fewer than 5 modules may even show lower scores on the post-test than they did on the pre-test.
5. Although males did better on the pre-test, males and females did equally well on the post-test.
6. There was no significant effect of teacher difference on post-test scores.

APPENDIX

EVALUATION OF THE ENGLISH MICROLAB PROGRAM

PLEASE RATE YOUR ANSWERS TO THE FOLLOWING SET OF QUESTIONS ON A SCALE OF 1-5 AS FOLLOWS:

	Strongly Disagree 1	2	3	4	Strongly Agree 5
CONTENT OF THE PROGRAM:					
1. The directions and explanations are clear.	0%	5%	26%	45%	24%
2. The level of the subject matter is appropriate for college freshmen.	6	8	31	36	19
3. The modules cover each subject adequately.	1	10	25	37	24
INSTRUCTIONAL DESIGN OF THE PROGRAM:					
1. The program is easy to use.	0	6	8	33	53
2. The material is presented in a logical order.	1	10	21	40	28
3. The program disks run without difficulty.	2	16	21	28	33
4. The feedback from each module is useful.	2	8	31	33	16
EFFECT OF THE PROGRAM ON MY WORK:					
1. The program is motivational.	11	25	35	20	5
2. The use of a computer in English instruction is helpful.	1	12	17	42	28
3. The Microlab Program helped me improve my writing.	6	16	25	35	18
4. The Microlab Program increased my understanding of grammar.	6	11	30	37	16
5. A workbook or classroom presentation would be more helpful.	6	11	30	25	24
ORGANIZATION OF THE LAB:					
1. An instructor should work more closely with Microlab groups.	6	18	29	27	19
2. The explanations of how to complete the lab and fill out the progress chart were clear.	4	7	30	40	19
3. The time assigned for lab work was convenient.	7	11	16	34	33
4. A computer was available at my scheduled time.	1	4	13	23	59

PLEASE ANSWER THESE QUESTIONS:

1. What did you like best about the English Microlab program?

(see attachments)

2. What did you like least about the program?

(see attachments)

3. What suggestions do you have for improving the program or its applications in English 4?

(see attachments)

4. My major is (list available in The LOFT).

5. My career choice is "".

PLEASE EVALUATE YOUR PARTICIPATION IN THE PROGRAM:Please check all answers that apply to you. Your honesty will be very helpful to us in determining whether this program is worthwhile.

How do you rate the effort you gave to the English Microlab Program:

14% 100% effort
57% 75% effort
21% 50% effort
9% less than 50% effort

I completed approximately ** modules in the Microlab Program.

48% I took the program seriously and found it to be helpful.
___ I would like to have more help with English:
24% tutoring in writing.
18% tutoring in grammar.
7% computer review and games in English skills.

85% I think an understanding of English grammar and writing skills is important to my success in college and in my career.

** Modules completed:	0	1	2	3	4	5	6	7	8	9	10	11	13*	15*
	4%	0	0	2%	4%	7%	1%	9%	5%	9%	4%	48%	5%	2%

* There are 11 modules in the program.

Please note that these calculations are based on students' answers. The Microlab worksheets show, for example, that 34% actually recorded working on exercises in 11 modules.

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